DOCUMENT RESUME

ED 217 059 TM 820 271

AUTHOR Bowker, Richard
TITLE Aptitudes and Length of Education. Technical Report 1981-7.
INSTITUTION Johnson O'Connor Research Foundation, Boston, MA.
PUB DATE Sep 81
NOTE 10p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Academic Aptitude; Adults; *Correlation; *Educational Attainment; *Scores; Vocabulary

ABSTRACT

Vocabulary and aptitude test scores were compared with length of education for adult examinees of the Johnson O'Connor Research Foundation. The length of education seemed to be an important determinant of economic success. The sample population averaged four years of college, which is a higher mean than the general population. Test scores accounted for twenty four percent of the variance in length of education, with most of the relationship due to the effect of vocabulary. The increase in median vocabulary percentiles is greater in the college years, than between college graduates and M. A.'s. This indicated college attendance had the greatest impact on vocabulary development. There was an influence of vocabulary on education and education on vocabulary. Personality tests were used to identify subjects as objective or subjective. Objective people tended to be generalists, while subjective people tended to be specialists. Personality had a small, but negative, correlation with educational level. There was a slight tendency for people scoring toward the subjective end of the scale to have more education than those toward the objective end of the scale. The relationship of individual tests to length of education was examined in detail. (Author/DWH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED217059

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

APTITUDES AND LENGTH OF EDUCATION

by

Richard Bowker

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
R. Bowker
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TM 820 271

JOHNSON O'CONNOR RESEARCH FOUNDATION
HUMAN ENGINEERING LABORATORY

Technical Report 1981-7

September 1981

Aptitudes and Length of Education

Richard Bowker

SUMMARY: Vocabulary and aptitude test scores were compared with length of education for adult examinees of the Johnson O'Connor Research Foundation. Test scores accounted for 24 percent of the variance in length of education, with most of the relationship due to the effect of Vocabulary. This is within the range of 20-40 percent obtained by Jencks et al. (1979) for the influence of test scores on educational attainment. The relationship of several individual tests to length of education was examined in more detail.

Introduction

This report studies the relationship between test scores and length of education of aptitude-testing examinees of the Johnson O'Connor Research Foundation. Since these examinees were tested after the completion of their education, it is not possible to determine the direction of the causality in the observed relationships. Does education foster the development of a particular ability, or does the presence of a particular ability facilitate education? However the data as presented do shed some light on the relationship of some basic cognitive abilities to level of education.

This topic is of interest given the finding that length of education, particularly beyond high school, is an important determinant of economic success (Jencks et al., 1979). Jencks's analysis of various studies shows that test scores explain between 20 and 40 percent of the variance in educational attainment (pp. 103-105); it will be seen that the present study offers further support for these estimates. In addition, it will look at the relationship of certain individual test scores to education in more detail.

Subjects

Subjects were aptitude-testing examinees of the Johnson O'Connor Research Foundation. For most analyses, examinees between the ages of 25 and 40 were used; there were a total of 377 examinees in this age group. Adult examinees typically come for testing because of dissatisfaction with their jobs or a general uncertainty about career paths. To this extent therefore they probably do not constitute a representative sample of people with their educational background; presumably, for example, some are dissatisfied because they dropped out of school or otherwise did not get the amount of schooling that their abilities would typically warrant. It is not known how much this will affect the generalizability of the results.

Education

Information about level of education and degree received was obtained from each examinee. The actual number of years of education completed

was entered on computer. The following standard entries were used for degree levels: high school diploma=12, MA=16, Ph.D.=21, M.D.=21.

Tests

The following tests were used in one or more of the analyses:

Graphoria, Wks. 613. A measure of clerical speed and accuracy.

Ideaphoria, Wks. 161. A measure of idea flow, in which examinees are asked to write as much as they can about a fanciful topic in ten minutes.

Foresight, Wks. 307. A measure of divergent thinking, in which examinees are shown abstract drawings and must say as many things as possible that the drawings look like or remind them of.

Inductive Reasoning, Wks. 164. A highly-speeded measure of an ability to generalize, in which examinees must choose which three of six pictures have something in common.

Analytical Reasoning, Wks. 244. A measure of another reasoning ability; in it examinees must organize a set of words into a given pattern.

Wiggly Block, Wks. 4-6. A measure of Structural Visualization, an ability to picture mentally the structure of three-dimensional forms.

Paper Folding, Wks. 622. Another measure of Structural Visualization.

Silograms, Wks. 376. A paired-associates word-learning task.

Personality, Wks. 35. A word-association test that divides people into categories labeled Subjective and Objective.

Vocabulary, Wks. 690. A multiple-choice vocabulary test.

Results

1. Length of education.

Table 1 gives the mean education level by sex for the Foundation examinees aged 25-40.

Table 1

Mean Education Level by Sex

	N	Mean	SD
Males	201	16.0	1.9
Females	176	15.9	1.6
Total	377	16.0	1.8

This sample, therefore, averages a full four years of college. This is a much higher mean than in the general population. Jencks (1979), for example, analyzes eleven studies of adult men, with mean educations ranging from 10.4 to 14.4. There is much less variation in this sample as well; the range of standard deviations in the Jencks studies was 2.4 to 3.7. This restriction of range will tend to limit the size of relationships between education and other variables.

There is no overall sex difference in education level in the sample; further analysis, however, shows an interaction between sex and age, with younger females averaging more education than males, older females less education than males.

2. Prediction of Length of Education

Table 2 presents the correlations between education level and the tests. Means, standard deviations, and intercorrelations for all the variables are found in the appendix.

Table 2
Correlations with Education Level

Test	r	p	Test	r	p
Vocabulary	.43	<.001	Graphoria	.07	NS
Silograms	.33	<.001	Inductive Reasoning	.04	NS
Ideaphoria	.26	<.001	Paper Folding	.04	NS
Analytical Reasoning	.15	.001	Wiggly Block	.02	NS
Foresight	.14	.003	Personality	-.15	.001

Table 3 presents the details of a stepwise multiple regression analysis with these tests as the independent variables and education as the dependent variable. In the table, ΔSMC stands for the change in the squared multiple correlation uniquely associated with each variable. The four tests in the regression equation account for 24 percent of the variance in education level. The standard error of predicting level of education from the test scores is .9 years.

Table 3

Multiple Regresssion of Test Scores on Education Level

	ΔSMC	Beta
Vocabulary	.08	.33
Personality	.02	-.16
Silograms	.02	.14
Ideaphoria	.01	.10

Multiple R = .49

R-Square = .24

Standard Error = 0.9

It may be seen that Vocabulary is the best predictor of education level. If Vocabulary is omitted from the analysis, the Multiple R drops from .49 to .40, and the percentage of variance explained drops from 24 to 16. Both Silograms and Ideaphoria are verbal tests with rather high correlations with Vocabulary (.49 and .33 respectively). When Vocabulary is partialed out of the Silograms-Education correlation, the correlation drops from .33 to .15; likewise, the Ideaphoria-Education correlation drops from .26 to .13 when Vocabulary is partialed out.

As mentioned in the introduction, the studies analyzed by Jencks found test scores accounting for between 20 and 40 percent of the variance in length of education. Thus the Foundation tests are at the low end of this range. Two major factors probably account for this. The first is the restriction of range problem discussed earlier. The lowest relationship observed in the Jencks analyses was for a study which excluded men who did not reach twelfth grade and men who were still in school seven years after high school. The Foundation sample is similarly restricted at the low end of the scale.

The second factor is that many of the studies analyzed by Jencks primarily used tests of academic ability as opposed to aptitude tests. These included tests of reading comprehension and mathematics, which one might expect to be more closely related to success in education than some of the tests studied here.

Jencks also used data from Project Talent to calculate correlations between Talent tests and various criteria. Some of these tests apparently measure constructs similar to those measured by some of the Foundation tests. The correlations for the Talent tests, along with the similar Foundation tests, are presented in Table 4.

Table 4

Comparison of Project Talent and
Foundation Correlations with Education Level*

Talent	r	Foundation	r
Vocabulary	.48	Vocabulary	.43
Visualization	.27	Paper Folding	.04
Clerical Checking	.05	Graphoria	.07
Memory for Words	.28	Silograms	.33

*Project Talent data from Jencks et al. (1979)

The correlations are quite similar except for the two measures of Visualization: the Talent measure has a much higher correlation with education.

The Foundation data, therefore, appear similar to those found in other studies of the relationship between test scores and length of education. Foundation tests account for almost a quarter of the variance in length of education for adult examinees. Most of this effect is due to the influence of Vocabulary.

The following sections examine in more detail the relationships of individual

tests to length of education.

3. Vocabulary

Since Vocabulary has the highest correlation with length of education, it was felt that it would be useful to examine this relationship somewhat more closely. Table 5 gives the average vocabulary percentiles for selected years of education. Examinees aged 25 and up were used in this sample.

Table 5

Average Vocabulary Percentiles
by Level of Education

Years of Education	Median %ile	Range	n
< 12	22.5	5-85	14
12	25.2	5-90	46
14	40.4	5-95	59
16	59.3	5-95	263
18	67.5	5-95	98
21	35.0	5-95	5

If the highest category is ignored, since it has only five cases, it may be seen that there is a steep and continuous rise in median Vocabulary percentiles from below grade 12 through Masters level (18 years of education). The increases are greater in the college years than between college graduates and M.A.s, suggesting that college attendance has the greatest impact on the relationship. The range of scores is quite wide at each educational level (Foundation vocabulary scores go from the 5th to the 95th percentile, so that four of the six levels span the maximum range). This is particularly interesting for the 21 years of education level: it is apparently possible to reach the Ph.D. level with an extremely low vocabulary.

It should be stressed that, since the vocabulary testing took place after the educational level was attained, the direction of the causality is unclear. The similarity of the Foundation and Project Talent correlations between vocabulary and education certainly point to an influence of vocabulary on education, since the Talent data were collected during high school. It is also likely that education influences vocabulary, since vocabulary development would occur through the reading done in school.

4. Personality

The Foundation Personality test measures the degree to which an examinee gives certain responses on a word association test. Examinees who give many of these responses are labeled "Objective"; examinees who give few or none of these responses are labeled "Subjective". The interpretation of these scores, in brief,

is that Objective people tend to be generalists, preferring jobs involving a wide variety of activities or people; Subjective people tend to be specialists, preferring a narrower focus in their work.

Personality has a small but significant negative correlation with education level (-.15). This means there is a slight tendency for people scoring towards the Subjective end of the scale to have more education than people scoring towards the Objective end of the scale. This relationship is not mediated by Vocabulary, since Vocabulary has a small positive correlation with Personality (.04).

This may be interpreted as supporting the generalist-specialist dichotomy, since it might be assumed that specialists would require more education than generalists. Alternative interpretations are also available. For example, it may be that the test, by measuring conformity of responses, in effect measures degree of socialization. The finding then would be similar to Jencks's finding, using Project Talent data, that more socially oriented people obtain less education than others (and thereby end up in lower-status occupations) (p. 132). Objective people, by this interpretation, might be less interested in school because they are more interested in other people.

5. Foresight

The significant positive correlation between Foresight and education (.14) replicates previous Foundation findings. These findings have led to the theory that a high score on this test influences educational attainment, perhaps because a good performance on the test indicates a degree of persistence, or ability to stick to a long-term goal.

However these previous studies did not control for the influence of vocabulary on both variables. The partial correlation between Foresight and education, controlling for Vocabulary, is only .03. Thus it appears that the relationship between Foresight and education is primarily a function of the relationship of both of these variables to Vocabulary.

The theory of a link between Foresight scores and education does not necessarily assume, however, that this relationship is linear (which is the relationship examined by the product-moment correlation). For example, graduates of junior colleges, with 14 years of education, might be assumed to be higher in Foresight than people with 15 years of education, who presumably went to a four-year college for three years and then dropped out.

Since degree obtained (or not obtained) was not coded in the data file, this hypothesis could not be tested directly. An approximation to it could be obtained, however, by using people with 16 years of education as probable graduates, and people with 13 or 15 years of education as probable dropouts. It was felt that there would be few cases when these categorizations were not true, so that the resulting data would probably be accurate.

Table 6 shows the actual Foresight means and the adjusted means, controlling for vocabulary level, of the two groups.

Table 6

Actual and Adjusted Foresight Means
for College Dropouts (educ.=13, 15) and Graduates (educ.=16)

	Actual Mean	Adjusted Mean	n
Dropouts	72.0	75.1	63
Graduates	74.4	73.6	216

While graduates score somewhat higher than dropouts in Foresight, this difference is due entirely to Vocabulary. When the means are adjusted for the difference in vocabulary levels, the dropouts actually score slightly higher in Foresight than the graduates. Thus, the data offer no support for the relationship between Foresight and education suggested by the theory.

Reference

Jencks, C., Bartlett, S., Corcoran, M., Crouse, J., Eaglesfield, D., Jackson, G., McClelland, K., Mueser, P., Olneck, M., Schwartz, J., Ward, S., & Williams, J. Who gets ahead? New York: Basic Books, Inc., 1979.

Appendix

Means, Standard Deviations, and Intercorrelations of Education and Foundation Tests

	Mean	SD
Education	16.0	1.8
Vocabulary	174.7	31.5
Foresight	76.1	33.1
Ideaphoria (%ile)	55.0	28.2
Analytical Reasoning	34.6	7.7
Inductive Reasoning	140.8	24.5
Wiggly Block (%ile)	44.5	27.3
Paper Folding	17.1	12.7
Personality	14.9	6.8
Silograms (%ile)	60.8	27.8
Graphoria	166.6	23.6

	Ed	Vocab	Frst	Idea	AR	IR	WB	PF	Prsty	Slgm	Graph
Ed	-	.43	.14	.26	.15	.04	.02	.04	-.15	.33	.08
Vocab	.43	-	.26	.33	.38	.16	.14	.24	.05	.49	.20
Frst	.14	.26	-	.24	.21	.24	.09	.10	-.09	.17	.13
Idea	.26	.33	.24	-	.17	.14	.05	.10	-.11	.21	.23
Ar	.15	.38	.21	.17	-	.30	.42	.43	.08	.27	.21
IR	.04	.16	.24	.14	.30	-	.25	.21	.04	.16	.22
WB	.02	.14	.09	.05	.42	.25	-	.64	.04	.06	.00
PF	.04	.24	.10	.10	.43	.21	.64	-	.05	.21	.07
Prsty	-.15	.05	-.09	-.11	.08	.04	.04	.05	-	.01	.04
Slgm	.33	.49	.17	.21	.27	.16	.06	.21	.01	-	.23
Graph	.08	.20	.13	.23	.21	.22	.00	.07	.04	.23	-

n = 377 males and females, age 25-40